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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/812,117	03/29/2004	Richard L. Elliott	2269-6990.2US	7596

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TRASK BRITT
P.O. BOX 2550
SALT LAKE CITY, UT 84110

EXAMINER

NOVACEK, CHRISTY L

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 05/12/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/812,117

Applicant(s)

ELLIOTT ET AL.

Examiner

Christy L. Novacek

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 February 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 12-21 is/are allowed.
- 6) ☒ Claim(s) 1-8 and 11 is/are rejected.
- 7) ☒ Claim(s) 9 and 10 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 2/27/06.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____.

DETAILED ACTION

This office action is in response to the amendment and terminal disclaimer filed February 27, 2006.

Terminal Disclaimer

The terminal disclaimer filed on February 27, 2006 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of prior patent US 6,593,657 has been reviewed and is accepted. The terminal disclaimer has been recorded. Therefore, the double patenting rejections of claims 15-17, 19 and 21 are hereby withdrawn.

Specification

The disclosure is objected to because of the following informalities: Paragraph 0029 on page 10 of the specification recites, "The dielectrics include, but are not limited to oxides, nitrides, carbides, carbon nitrides, oxynitrides, doped or slightly doped monocrystalline or polycrystalline silicon, and their equivalents." However, doped or slightly doped monocrystalline or polycrystalline silicon are not dielectric materials. Applicant's assertion that "doped or slightly doped monocrystalline or polycrystalline silicon" can be doped with oxygen and, therefore, can allegedly be "semi-insulating" is not sufficient to overcome this objection. Section 2111.01 of the MPEP states, "During examination, the claims must be interpreted as broadly as their terms reasonably allow. This means that the words of the claim must be given their plain meaning unless applicant has provided a clear definition in the specification. *In re Zletz*, 893 F.2d 319, 321, 13 USPQ2d 1320, 1322 (Fed. Cir.1989) (discussed below)>; *MSM*

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Investments Co. v. Carolwood Corp., 259 F.3d 1335, 1339-40, 59 USPQ2d 1856, 1859-60 (Fed. Cir. 2001).” Applicant’s specification provides no definition of “doped or slightly doped monocrystalline or polycrystalline silicon”. Particularly, Applicant’s specification does not disclose doping the monocrystalline or polycrystalline silicon with oxygen. Therefore, in the instant application, the term “doped or slightly doped monocrystalline or polycrystalline silicon” is given its plain and ordinary meaning in the art, which is that the silicon is doped with an n-type or p-type dopant. Monocrystalline and polycrystalline silicon are semiconductive materials. Doped with an n-type or p-type dopant, the silicon becomes more conductive. In no way can “doped or slightly doped monocrystalline and polycrystalline silicon” be considered to be dielectric materials. Even if the silicon were doped with oxygen enough for the material to become insulative, the resulting material would be correctly termed a “silicon oxide” and not a “doped silicon”. Therefore, the objection to the specification is maintained.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 6 and 21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 6 and 21 recite that the “insulation layer comprises a material selected from the group consisting of oxides, nitrides, carbides, carbon nitrides, oxynitrides, doped monocrystalline silicon or doped polycrystalline silicon.” However, doped monocrystalline and polycrystalline silicon are not insulative materials. They are conductive.

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The arguments stated above in reference to the objection to the specification also apply to this rejection of claims 6 and 21 under 35 U.S.C. 112, second paragraph.

Claim Rejections - 35 USC § 102

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1-6 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Lee et al. (US 5,355,020, cited in IDS).

Regarding claim 1, Lee discloses forming an insulation layer (32) situated on a semiconductor substrate (31), forming a contact hole in the insulation layer to expose a contact surface on the semiconductor substrate, and forming a single layer of metal (37) upon a top planar surface of the insulation layer, the single layer of metal substantially filling the contact hole and being in electrical contact with the contact surface on the semiconductor substrate (col. 10, ln. 57 – col. 11, ln. 62; col. 14, ln. 39 – col. 16, ln. 16). Lee does not specifically disclose that the single layer of metal has a substantially planar top surface. However, Lee does disclose that the single layer of metal is subjected to a heat treatment process wherein the single layer of metal is heated to a temperature up to its melting point whereby the metal flows into the contact hole to completely fill the hole (col. 11, ln. 25-54). Lee also discloses that when this same heating process is conducted on another metallic layer, the metallic layer becomes planarized (col. 16, ln. 6-16). Because Lee discloses that the heating process planarizes the second metal layer, it appears that the heating process also inherently planarizes the first metal layer. See *In re Swinehart*, 439 F.2d 210, 212-13, 169 USPQ 226, 229 (CCPA 1971) “where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in

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the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that the subject matter shown to be in the prior art does not possess the characteristics relied on ”); and *In re Fitzgerald*, 619 F.2d 67, 205 USPQ 594 (CCPA 1980) (a case indicating that the burden of proof can be shifted to the applicant to show that the subject matter of the prior art does not possess the characteristic relied on whether the rejection is based on inherency under 35 U.S.C. 102 or obviousness under 35 U.S.C. 103).

Regarding claim 2, Lee discloses that the single layer of metal comprises an alloy of a metal (col. 11, ln. 16-23).

Regarding claim 3, Lee discloses that the single layer of metal comprises a material selected from the group consisting of Al, AlCu, and AlCuSi (col. 11, ln. 16-23).

Regarding claim 4, Lee discloses that the single layer of metal comprises a material selected from the group consisting of AlSi and AlTi (col. 11, ln. 16-23).

Regarding claims 5 and 6, Lee discloses that the insulation layer comprises a material selected from the group consisting of doped silicon dioxide, BPSG and BSG (col. 11, ln. 3-6).

Regarding claim 11, Lee discloses forming a single layer of metal by using a PVD deposition process (sputtering) (col. 15, ln. 17-19).

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. (US 5,355,020) in view of Sahota (US 5,840,623, previously cited).

Regarding claim 7, Lee discloses depositing the single layer of metal upon the top surface of the insulation layer, the single layer of metal having a selected thickness, treating the semiconductor substrate in an environment of a selected pressure range and a selected temperature range so as to cause the single layer of metal to substantially fill the contact hole, heat treating the single layer of metal, and forming a metal line having a selected shape from the single layer of metal (col. 10, ln. 57 – col. 11, ln. 62; col. 14, ln. 39 – col. 16, ln. 16). Lee does not specifically disclose that the single layer of metal has a substantially planar top surface. However, Lee does disclose that the single layer of metal is subjected to a heat treatment process wherein the single layer of metal is heated to a temperature up to its melting point whereby the metal flows into the contact hole to completely fill the hole (col. 11, ln. 25-54). Lee also discloses that when this same heating process is conducted on another metallic layer, the metallic layer becomes planarized (col. 16, ln. 6-16). Because Lee discloses that the heating process planarizes the second metal layer, it appears that the heating process also inherently planarizes the first metal layer. Lee does not disclose planarizing the insulation layer to form the top surface of the insulation layer. Like Lee, Sahota discloses forming metallization interconnect structures in an insulation layers. Sahota discloses that it is conventional in the art to planarize the surface of the insulation layer (col. 1, ln. 6-36). At the time of the invention, it would have been obvious to one of ordinary skill in the art to planarize the insulation layer of Lee because it is conventional in the art to planarize the insulation layer in order to prevent photolithography problems.

Regarding claim 8, Lee discloses patterning and etching the single layer of metal into the metal line having the selected shape (col. 16, ln. 23-32).

Response to Arguments

Applicant's arguments filed February 27, 2006 have been fully considered but they are not persuasive.

Regarding the objection to the specification and the rejections of claims 6 and 21 under 35 U.S.C. 112, second paragraph, as stated above, in the instant application, the term “doped or slightly doped monocrystalline or polycrystalline silicon” is given its plain and ordinary meaning in the art, which is that the silicon is doped with an n-type or p-type dopant. Monocrystalline and polycrystalline silicon are naturally semiconductive materials. Doped with an n-type or p-type dopant, the silicon becomes more conductive. In no way can “doped or slightly doped monocrystalline and polycrystalline silicon” be considered to be dielectric materials. Even if the silicon were doped with oxygen enough for the material to become insulative, the resulting material would be correctly termed a “silicon oxide” and not a “doped silicon”. Therefore, the objection to the specification and the rejections of claims 6 and 21 under 35 U.S.C. 112, second paragraph are maintained.

Regarding the rejection of claim 1 as being anticipated by Lee, Applicant argues that Lee allegedly fails to disclose forming “a single layer of metal” “substantially filling the contact hole”. Figure 13 of Lee shows that layer 37 substantially fills the contact hole. Lee discloses forming layer 37 by depositing an Al-Si or Al-Cu-Si material followed by depositing an Al, Al-Cu or Al-Ti material (col. 15, ln. 8-51). These materials are then annealed at a temperature of 500-550°C. Lee repeatedly refers to layer 37 as “a composite metal layer” and “a first

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conductive layer” (col. 15, ln. 8-51; claims 1-32). Therefore, Lee meets the limitation of forming “a single layer of metal” substantially filling the contact hole”.

Further regarding the rejection of claim 1 as being anticipated by Lee, Applicant argues that Lee allegedly fails to disclose forming the single layer of metal such that it has “a substantially planar top surface upon a top planar surface of the insulation layer”. Firstly, it is pointed out that the limitation recites that the top surface of the metal is “*substantially*” planar and not, completely planar or perfectly planar. In fact, Applicant’s own Figure 2 shows that the single layer of metal does not have a perfectly planar top surface, but only a *mostly* planar top surface. Lee discloses that layer 37 (made of Al-Si or Al-Cu-Si and Al, Al-Cu or Al-Ti) is annealed to a temperature that causes the aluminum in the layer to become fluid so as to completely fill the contact openings (col. 15, ln. 31-42). After this anneal step, another layer 38 of Al-Cu or Al-Ti is deposited onto layer 37 and Lee discloses that this second layer is heat-treated “to thereby planarize the surface of the wiring layer” (col. 16, ln. 6-8). It is submitted that by heating the substrate to a temperature that is sufficient to cause the second layer 38 to become fluid enough to planarize, the heating is also sufficient to cause the first layer 37 to become fluid and planarize, as the first and second layers *are made of the same materials*. By subjecting the first layer 37 to two annealing steps that are sufficient to cause the layer to become fluid, the layer inherently becomes “substantially planar”. Therefore, Lee meets the limitation of the single metal layer having a “substantially planar” top surface.

Also regarding the rejection of claim 1 as being anticipated by Lee, Applicant argues that the single layer of metal of Lee is allegedly not “in contact” with the surface of the substrate. The term “in contact” can refer not just to physical contact, but also electrical contact as well, as

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evidenced by Applicant's original claim 1. As recited in claim 1, the limitation of forming the single layer of metal such that it is "in contact with the contact surface" is actually a broader limitation than "in electrical contact with said contact surface." Lee discloses that the single layer of metal 37 is in electrical contact with the contact surface. Therefore, Lee meets this limitation in the claim.

Allowable Subject Matter

Claims 9 and 10 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 12-21 are allowed.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

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however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christy L. Novacek whose telephone number is (571) 272-1839. The examiner can normally be reached on Monday-Thursday and alternate Fridays 7:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on (571) 272-2429. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CLN
May 2, 2006


Zandra V. Smith
Supervisory Patent Examiner
5/10/2006